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# ***JPRS Report***

# **Science & Technology**

***USSR: Earth Sciences***

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# Science & Technology

## USSR: Earth Sciences

JPRS-UES-89-005

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## Ecology

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## Ecological and Seismic Studies in Area of Nuclear Testing Grounds

18650192a Alma-Ata KAZAKHSTANSKAYA PRAVDA  
in Russian 20 May 89 p 3

[Article by V. Ovcharov, correspondent (Moscow)]

[Abstract] The article is an interview with Vladimir Aleksandrovich Bukatov, deputy chairman of a state commission of the USSR Council of Ministers and head of a group of specialists which has been investigating radiation, seismic, sanitary and ecological conditions in the vicinity of the nuclear testing grounds near Semipalatinsk [see also the *Daily SNAP*, April 17, 1989, p 2, col 2].

These and other activities were prompted by an escape of radioactive inert gases from the earth's interior which occurred on February 12 of this year, it is recalled. These gases, which formed during an underground nuclear explosion, were carried by the wind in the direction of Komsomolskiy settlement and caused the level of radiation to rise briefly there. This presented no hazard to the settlement's inhabitants, it is claimed. A special commission nevertheless was created to inspect the operation of the Semipalatinsk testing grounds. This commission consisted of representatives of the USSR Council of Ministers; the Central Committee of the Communist Party of the Soviet Union; the ministries of health, defense and medium machine building; and the USSR state committees on labor and wages, hydrometeorology (Goskomgidromet) and nature conservation (Goskompriroda). Another response to the February event has been the appearance of a public movement called "Nevada," which advocates immediate cessation of the Semipalatinsk tests. Bukatov comments on results of the special commission's work and reports information which has been gathered on local radiation conditions, for the purpose of dispelling unfounded rumors.

Bukatov points out that the number of nuclear explosions which the USSR has conducted in the interests of national security during the last four years is only two-thirds the number conducted in the United States during the same period, roughly speaking. He reports that no relationship has been established between the illness rate among the population and radiation conditions in the region of the testing grounds. Background radiation on the territory of the grounds and in Semipalatinsk Oblast is approximately 17 microroentgens per hour. The average figure for natural background radiation for the country as a whole is 20 microroentgens per hour.

Bukatov mentions safety recommendations which have been issued to appropriate ministries and agencies on the basis of the special commission's findings. These recommendations call in particular for reducing the number and intensity of explosions at the Semipalatinsk grounds; introducing more rigid requirements for the design of testing structures and stricter technical supervision of the preparation and conduct of tests; placing charges at a greater depth; and expanding research of the geological structure of soils in places where tests are conducted.

Bukatov recalls that the force of the most recent test explosion at the Semipalatinsk grounds was substantially below that of earlier ones. It was decided to cancel tests planned for March, April and May, so that proposals and recommendations of the commission could be carried out.

It was discovered on the other hand that local ecological conditions which have no connection with the Semipalatinsk testing grounds need to be improved, Bukatov reports. These conditions result from heavy concentration of industrial and construction enterprises in Semipalatinsk, Ust-Kamenogorsk and neighboring areas. An expedition consisting of representatives of the ministries of health and defense and USSR Goskompriroda and Goskomgidromet was sent to Semipalatinsk in this connection on May 11. This expedition was to conduct a comprehensive examination of ecological conditions and the health of the population in the region, with the participation of local health-care agencies. It is planned to hold a conference of specialists and the general public in Semipalatinsk, in accordance with results of this examination.

Bukatov also mentions plans for studying seismic effects of underground nuclear explosions on buildings and other structures in the region of the testing grounds. This study was to be conducted at an early date, with the participation of the Kazakh SSR State Construction Committee and institutes of the republic Academy of Sciences. Results of the seismic studies will be taken into account in conducting future explosions.

FTD/SNAP

## Limited Demand Delays Introduction of Seismic-Monitoring Equipment

18650192b Moscow PRAVITELSTVENNYY VESTNIK  
in Russian No 1, Jan 89 p 5

[Article by N. P. Laverov, vice-president of the USSR Academy of Sciences]

[Excerpt] Extract: Such structures as nuclear power stations, tall water dams and chemical production facilities must be reliably guaranteed against earthquake shocks. The growth of large cities and the increasing density of population also heighten vulnerability to earthquakes. All of these things have made it necessary to take into account the seismicity of territories which were formerly considered auspicious. The time has therefore come to talk about evaluating seismic hazards not for 20 percent of our territory but for at least 35-40 percent.

The existing system of regular observations must be drastically changed. It is now obvious that from the practical standpoint, the task of forecasting far exceeds the capabilities of the USSR Academy of Sciences and republic academies and necessitates the organization of a state geophysical observation service. Stationary and

mobile apparatus must be specially developed for such a service. The whole system of stations must be linked together by a telecommunications network based on satellite communications.

The methodological basis of forecasting must be expanded. Not only seismological stations but geochemical, hydrogeological, biological and other kinds of stations must be organized and a set of methods for long-, medium- and short-term forecasting of earthquakes must be developed for this purpose.

Our equipment resources are lagging substantially at present. And yet there are a number of developments and experimental prototypes whose technical parameters are equal to those of foreign ones but which our instrument-building industry has not begun to produce. The

design bureau and experimental production facility of the USSR Academy of Sciences' Institute of Earth Physics require fundamental retooling. The academy is not capable of producing seismic equipment in the needed amounts.

We are ready to turn over to industry, for production, prototypes of a deep-level seismic station which automatically records vibrations on the floors of oceans, and also a wide-band seismic station for a future state seismic-observation service. However, enterprises are reluctant to begin producing items of which the amount required is measured in the dozens and sometimes only in single digits.

FTD/SNAP

UDC 532.529+532.517.4

### Degeneration of Layered Structures in Stratified Fluid Shear Flow

18650088b Kiev *MORSKOY GIDROFIZICHESKIY ZHURNAL* in Russian No 1, Jan-Feb 89 (manuscript received 10 Nov 87) pp 11-14

[Article by Ye. N. Getman and V. I. Nikishov, Hydro-mechanics Institute, Ukrainian Academy of Sciences]

[Abstract] Currents with a vertical velocity shear are usually present in ocean waters. The influence of such currents on the degeneration of small-scale movements in an unbounded temperature-stratified fluid is examined on the assumption that the characteristic time of change of the parameters of these movements is small in comparison with the characteristic period of change of the mean current and that the spatial variability of currents is small along the horizontal direction. This makes it possible to consider these currents to be stationary and uniform along the horizontal direction. It is shown that the behavior of the disturbances in the final stage is determined by the joint influence of viscosity, thermal conductivity, collapse and expansion of material lines due to velocity shear. The behavior of velocity and density disturbances is analyzed for the case of predominance of viscous forces due to the presence of the velocity shear. References 8: 5 Russian, 3 Western.

UDC 551.466.315

### Integral Parametrical Wind-Wave Prediction Model Consistent With All-Union Wave-Related Construction Specifications and Regulations

18650088c Kiev *MORSKOY GIDROFIZICHESKIY ZHURNAL* in Russian No 1, Jan-Feb 89 (manuscript received 5 May 88) pp 24-29

[Article by G. V. Matushevskiy and I. M. Kabatchenko, State Oceanographic Institute, USSR State Committee for Hydrometeorology and Environmental Control]

[Abstract] In its modern formulation, the concept of an integral parametrical wind-wave prediction model involves frequency integration of the energy budget (or wave action) equation. The authors propose a wind-wave model that is consistent with the all-union construction specifications and regulations (SNIP 2.06.04-82) and predicts waves in complex conditions over a fetch of more than 100 km. The model makes it possible to avoid the difficulties which usually arise when choosing the right-hand side of the wave energy budget equation. The model can be adapted to any dependence of wave energy on certain types of wave-determining factors that take atmospheric stratification into account. A frequency spectrum expression is derived which can be used in writing formulas for determining mean group velocity and for computing wave swell. In calculating energy advection for long distances, additive corrections must be made to the appropriate terms of the equation. The

angular distribution of energy used in the model shows good agreement with JONSWAP data. The energy budget equation is solved numerically on the basis of energy advection and its local pumping, with an assigned wind field that is variable in time and space. The well-known Longuet-Higgins theorem on invariance of the two-dimensional spectrum or the discrete ray technique can be used in predicting swell waves. Figure 1; references 22: 11 Russian, 11 Western.

UDC 551.465.001.573(261.1)

### Choice of Dynamic-Stochastic Model for Monitoring Ocean: Compromise Between Accuracy and Cost of Computations

18650088d Kiev *MORSKOY GIDROFIZICHESKIY ZHURNAL* in Russian No 1, Jan-Feb 89 (manuscript received 23 Mar 88, after revision 19 Jun 88) pp 30-36

[Article by I. Ye. Timchenko, V. O. Belozerskiy, S. I. Khlopushina and V. A. Benzhitskiy, Marine Hydro-physics Institute, Ukrainian Academy of Sciences]

[Abstract] An important practical problem in oceanology is computer monitoring of the variability of the real ocean. The best developed approach to its solution is four-dimensional analysis of observations using dynamic-stochastic models (DSM). The more complex the DSM, the greater the accuracy of the picture of ocean dynamics. However, the more complex models considerably increase the computer load, which greatly increases data processing costs. A study was therefore made to find a compromise between accuracy and cost requirements and to compare different DSM of the ocean with respect to accuracy and computation cost criteria. Specifically, two DSM are compared for a large-scale test range in the North Atlantic. The rms error (for a horizon) in retrieving the density and current fields was used as the criterion of comparison. It is shown that in some cases it is desirable to use DSM with a simplified hydrodynamic element. This makes it possible to increase the speed of computer calculations and reduce their cost without worsening the quality of retrieval of hydrophysical fields. Figures 2; references 15: 11 Russian, 4 Western.

UDC 551.465.48

### Evolution of Rossby Waves Generated by Localized Effects

18650090a Moscow *OKEANOLOGIYA* in Russian Vol 29 No 1, Jan-Feb 89 (manuscript received 27 May 88) pp 5-20

[Article by V. M. Kamenkovich, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] A study was made of the propagation of nondivergent and divergent (one- and two-dimensional) Rossby waves generated by spatially localized external

effects and initial disturbances. In the case of temporal invariability of the external effects, for all types of waves it was found that over long time intervals the solution of the problem in a limited region of space tends to a Sverdrup solution. With an external effect changing in time it is shown that resonance is absent in the case of nondivergent waves, and the possibility of resonance in the case of divergent waves is clarified. A substantial difference in the nature of temporal behavior of wave fields generated by isolated and distributed sources is demonstrated. Figures 2; references 16: 10 Russian, 6 Western.

UDC 551.465.42

### Point Eddies on Rotating Sphere

18650090b Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received  
28 Jun 88) pp 21-27

[Article by K. V. Klyatskiy and G. M. Reznik, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Earlier articles demonstrated the existence of point eddies of a new type: point eddies on the  $\beta$  plane that form systems moving in a zonal direction in a steady-state fashion. A distinguishing feature of such an eddy is a dependence of the eddy velocity field on the velocity of its movement as a whole. If the velocity of movement of the eddy system lies outside the range of velocities of linear Rossby waves, the velocity field decays exponentially, and such a system is the simplest Rossby soliton. Since the theory of Rossby solitons, which was initially developed for the  $\beta$  plane, has been generalized for a sphere, an attempt was made to generalize the theory of point eddies on the  $\beta$  plane for a sphere. This problem is of practical interest because systems of such point eddies can be used in modeling blocking eddy formations in the atmosphere and ocean. A study was made of a system of an arbitrary number of eddies moving in a steady-state fashion along a circle of latitude with the velocity  $\omega$ . Systems of two and three eddies are examined in greater detail. It is shown that the velocity field generated by eastward-moving systems decreases monotonically with increasing distance from the center of the system. The rate of decay increases with a decrease in velocity  $\omega$ . Westward-moving systems always generate nonattenuating, oscillating velocity fields. Figures 3; references 9: 6 Russian, 3 Western.

UDC 551.465.48

### Surface Mesoscale Eddy Structures in Stratified Ocean

18650090c Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received  
12 Oct 87) pp 28-32

[Article by V. V. Zhmur, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] The author examines the nature of mesoscale surface eddy formations, which show up consistently on satellite images, but for which no theory is said to exist. In this article models of surface eddy formations of such a scale (10-30 km) with a continuous distribution of potential vorticity inside and outside the cores of such structures are proposed. A quasigeostrophic approximation is used for investigating such structures with a constant Vyaysyal-Brunt [Vyaysyal-Brent] frequency. Precise solutions are given for the potential vorticity equation for an infinitely deep ocean. It is shown that in a uniform flow the simplest structure is a dipole, whereas a flow with a shear has a more complex structure consisting of three strong and two weak eddies. The cores of such formations are flattened semiellipsoids. Figure 1; references 6: 5 Russian, 1 Western.

UDC 551.465.15

### Turbulence Generation in Core of Lomonosov Current in Vicinity of Local Frontal Zones

18650090d Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received 7 Dec 87,  
after revision 30 May 88) pp 41-48

[Article by T. S. Artemyeva, I. D. Lozovatskiy and V.N. Nabatov, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow; Atlantic Department, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Kaliningrad]

[Abstract] One of the timely problems in research on equatorial subsurface countercurrents is a determination of the mechanism of vertical exchange of matter through the central zone of the current, where the vertical velocity gradients are small and the Richardson numbers are large. Accordingly, the acquisition of experimental data on the spatial variability of the microstructural parameters of hydrophysical fields in this zone both along and across the current core is of great import. The first measurements suitable for solving this problem were made in the Lomonosov Countercurrent on the 13th cruise of the "Akademik Mstislav Keldysh" in February 1987 along meridian 3°W from 1°52'N to 0°30'S. The authors analyze these data, which were obtained with a towed turbulence meter and with synchronous measurements of the thermohaline structure of the upper part of the pycnocline, made in a scanning regime (59 pairs of soundings) with a horizontal spacing of about 2.5 miles. The data revealed local frontal zones in the cross section of the Lomonosov Countercurrent core that can be associated with the boundaries of individual current jets. In the vicinity of these "internal" fronts, small-scale turbulence is generated both because of the destruction of short internal waves and the sharp increase in horizontal shears of mean current velocity. Figures 3; references 16: 10 Russian, 6 Western.



UDC 551.465.15

### Mixed Region Collapse in Oceanic Pycnocline

18650090e Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received 9 Dec 87;  
after revision 24 May 88) pp 49-57

[Article by A. Yu. Benilov, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] A model of mixed region collapse in a stably stratified fluid is examined. An equation is derived which describes this phenomenon in all stages of its development for any degree of turbulence mixing of bounded volumes of fluid. A study was made of the collapse of two- and three-dimensional mixed regions at the density discontinuity and in a linearly stratified fluid. It is shown that with the collapse of a mixed region at the density discontinuity, the density inhomogeneity is completely absorbed by the discontinuity. The laws of change in the geometrical dimensions of collapsing regions for all stages of collapse as a function of stratification conditions in the fluid surrounding the mixed region and the degree of mixing within the region are indicated. The degeneration of a slightly mixed density inhomogeneity is examined. The latter disappears in the first inertial stage of collapse, leaving a collapse-induced velocity-field inhomogeneity degenerating under the influence of molecular viscosity and simultaneously increasing in size. Figure 1; references 17: 12 Russian, 5 Western.

UDC 551.466:532.59

### Direct Method for Solving Problem of Regular Waves Over Sloping Bottom

18650090f Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received  
9 Mar 87) pp 64-65

[Article by Sh. N. Gagoshidze, Georgian Electric Power and Fuel Raw Materials Scientific Research Institute, Tbilisi]

[Abstract] The problem of frontal run-up of waves onto a shore slope of arbitrary steepness is solved in a linear approximation on the basis of the use of a direct method proposed by Kantorovich. An equation is derived which can serve as a basis for numerical computations of regular waves in the coastal zone of the sea. In addition, it allows a possibility for obtaining asymptotic solutions for great and short distances from the shoreline. With short distances, this equation leads to a Bessel equation whose solution, corresponding to waves propagating in a shoreward direction, is expressed by a Hankel function of the first kind. The free surface is asymptotically described at great distances from the shoreline or over a steep underwater slope (two concepts that are regarded as equivalent here). References: 2 Russian.

UDC 551.465.74

### Selective Transport of Chemical Elements from Hydrosphere to Atmosphere in Physical Evaporation

18650090g Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received 14 Oct 87, after revision 4 Apr 88) pp 79-80

[Article by A. A. Kazarov, Scientific Research Institute of Chemistry of Free Radicals, North Osetian State University]

[Abstract] There is a fractional transport of salts into the atmosphere during physical evaporation. However, there has been little success in the search for the reason for metamorphization of salts during evaporation or in the determination of the relationship between the fractionation coefficient of chemical elements and the nature of the ions and their physicochemical properties in solution. In order to clarify these matters laboratory research was carried out using very simple systems—aqueous solutions containing only one electrolyte and thus precluding the influence of the possible nonadditive contributions of any background substances. The experiments were performed in a rotary vacuum evaporator and under natural conditions at atmospheric pressure. The condensates obtained under natural conditions and in the rotary evaporator gave identical results. A brief table gives: content of cations and ions in the condensate, fractionation coefficient of ions for each of six salts, pH of the initial solution and condensate. The reason for the differential transport of ions evident from this table is apparently an interphase boundary. The structure and physicochemical properties of the surface layer are dependent on the nature of its components and have little dependence on their concentration in the volume of the solution. References: 2 Russian.

UDC 551.463.8/550.47(261)

### Distribution and Composition of Suspended Matter in Waters of Northeastern Tropical Atlantic

18650090h Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received 10 Aug 87, after revision 24 Feb 88) pp 112-118

[Article by A. A. Bezborodov, Z. P. Burlakova and L. V. Yeremeyeva, Marine Hydrophysics Institute, Ukrainian Academy of Sciences, Sevastopol; Biology of the Southern Seas Institute imeni A. O. Kovalevskiy, Ukrainian Academy of Sciences, Sevastopol]

[Abstract] Long-term (1978-1985) data on the distribution and composition of suspended matter in the waters of the tropical Atlantic Ocean between 8°N and 11°N and 14°W and 19°W were analyzed. The data cover the region of the shelf seaward of the isobath 20 m, the continental slope and the abyssal part of the ocean. Three periods characterize the annual variations

observed in the water dynamics and river discharge for the area—a wet period, a dry period, and a transition period. The general nature of the distribution of suspended matter and its absolute concentrations is virtually identical for each period during different years and therefore these data can be combined. During all three periods the maximal concentrations of suspended matter are in the northeastern and southeastern parts of the region. Seaward the concentration decreases rapidly, and beyond the limits of the continental slope, it becomes virtually constant. In general, the concentration of suspended matter at the surface increases from the wet period to the dry period. The influence of large-scale circulation, upwelling, river discharge and eolian fallout on the patterns of distribution and on the formation of the biochemical composition of suspended matter is demonstrated. The content of organic carbon, nitrogen, chlorophyll, phytoplankton and metallic trace elements was determined. The seasonal variation of those components is ascertained. Figures 2; references 11: 5 Russian, 6 Western.

UDC 581.524.325

#### Macroscale Distribution of Quantitative Characteristics of Plankton in Pacific Ocean

18650090i Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received  
10 Jun 88) pp 121-126

[Article by M. Ye. Vinogradov and E. A. Shushkina, Oceanology Institute imeni A. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Quantitative structural and functional characteristics of the principal elements of plankton communities (phytoplankton, bacterioplankton, simple planktons, meso- and macroplankton) were obtained on the basis of an analysis of plankton in epipelagic regions of the Pacific Ocean for more than 200 stations. Their biomass, production, metabolic rate, and the role of metabolic rate in general heterotrophic destruction were estimated. These data were averaged for 12 geographical natural production regions (a map showing these regions is included). The change in the characteristics was determined on general meridional and latitudinal sections across the Pacific Ocean, which considerably supplements current ideas concerning its biological structure. It is evident that the change in abundance of plankton from the central tropical to coastal or moderately cold-water regions applies to a greater degree to phytoplankton and mesoplankton. The biomass of bacteria and microheterotrophic animals does not exhibit such substantial and regular changes. The production of the heterotrophic part of the community and the role of different groups in general heterotrophic destruction change negligibly. While experiencing sharp local fluctuations, in general they remain almost identical over the entire ocean area. Figures 2; references 9: 8 Russian, 1 Western.

UDC 551.46.08

#### Statistical Modeling of Dynamic Errors in Oceanological Measuring Instruments

18650090j Moscow OKEANOLOGIYA in Russian  
Vol 29 No 1, Jan-Feb 89 (manuscript received  
3 Aug 88) pp 149-152

[Article by V. M. Abramov, Leningrad Hydrometeorological Institute]

[Abstract] The dynamic modes of most oceanological instruments are described by complex nonlinear stochastic models. This article gives the results of development and testing of a universal quantitative method for probabilistic analysis of the dynamic modes of oceanological measuring instruments. The basis for the method is the statistical modeling of the dynamic errors of such instruments. The principal objectives of the described quantitative probabilistic analysis are defined. The method has already been used in analysis of the dynamic modes of various oceanological transducers. For example, the results of a study of the dynamic errors of rotary instruments for measuring the modulus of the velocity of oceanic currents under conditions of a highly fluctuating oncoming flow were given by the author in OKEANOLOGIYA, Vol 28, No 3, pp 502-506, 1988. Determination of the dynamic errors of a number of other instruments is also described for illustrating the possibilities of the method. References: 9 Russian.

UDC 551.463.5

#### Use of Antireflection Sphere Model for Calculating Light Scattering by Finely Dispersed Particles of Oceanic Suspended Matter

18650093b Moscow IZVESTIYA AKADEMII NAUK  
SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 25 No 2, Feb 89 (manuscript received  
29 Dec 87) pp 193-201

[Article by A. M. Kokorin and K. S. Shifrin, Oceanology Institute, USSR Academy of Sciences]

[Abstract] The finely dispersed particulate of a marine suspension is modeled with an isotropic ensemble of isotropically oriented, homogeneous, identical ellipsoids (system I) and homogeneous, identical cylinders of revolution (system II). Three models are used to compare the scattering characteristics in systems I and II: a homogeneous sphere model, a two-layer sphere model, and an antireflection sphere model. All the calculations were also made for natural light with the Rayleigh-Gans-Debye (RGD) method. Comparing the precise calculations for antireflection spheres and the RGD calculations made it possible to find the range of geometric parameters where the RGD method is satisfactory. This also makes it possible to determine the characteristics of an ensemble of aspherical particles for which the results of precise computations for antireflection spheres can be used. In the range of sizes and

refraction coefficients significant for oceanic suspended matter it is shown that an antireflection sphere is the best approximation for describing the properties of an isotropic ensemble. The cited computations can be adapted without difficulty to an anisotropic ensemble of particles, the model for which will be an "antireflection" ellipsoid. Figures 6; references 17: 11 Russian, 6 Western.

UDC 551.46:551.5

### **Influence of Thin Oil Films on Radiation Temperature of a Water Surface and on Gas Exchange Rate**

18650093c Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 25 No 2, Feb 89 (manuscript received 23 Nov 87, after revision 4 May 88) pp 202-206

[Article by V. V. Ivanov, M. P. Kolomeyev and V. M. Chekryzhov, Experimental Meteorology Institute]

[Abstract] The dependence of radiation temperature of a water surface, evaporation rate, and rate of gas exchange through the water-air interface on thickness of oil films was investigated in the laboratory under neutral stratification conditions. It was found that oil films with a thickness of about 0.015  $\mu\text{m}$ , exerting no effect on evaporation, reduce the rate of gas exchange and increase the temperature drop between the surface and deep water layers by a factor of about 2. An increase in oil film thickness from 0.03 to 1  $\mu\text{m}$  exerts no influence on the rate of gas exchange, but reduces the evaporation rate and temperature drop by several factors in comparison with a pure water surface. With a further increase in thickness of the oil film there is a monotonic decrease in the evaporation rate, gas exchange rate and temperature differential in the surface water layer. Figure 1; references 7: 6 Russian, 1 Western.

UDC 551.463.5:551.464:528.8

### **Retrieval of Concentrations of Foreign Matter in Eutrophic Waters of Baltic Sea From Spectrum of Ascending Radiation**

18650095b Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 89 (manuscript received 12 Oct 87) pp 27-33

[Article by V. N. Pelevin and V. L. Solomakha, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] A study was made of the possibility of using remote methods for studying the distributions of concentrations of foreign matter in the waters of Parnu Bay and the Gulf of Riga, which are characterized by high trophicity and severe anthropogenic pollution. The waters of these embayments contain suspended and dissolved substances that are either brought in by runoff or are formed during the blooming of plankton. The

ratio of different components may vary in a wide range. The objective of the research was to determine the concentration of each component separately on the basis of the spectrum of ascending radiation. A model of the spectral brightness coefficient of the sea is proposed which takes into account the contribution made by absorption by phytoplankton pigments, mineral suspended matter, and yellow matter, as well as the contribution made by backscattering by coarse and fine suspended matter and absorption and scattering by the water itself. The concentrations of foreign matter were determined at 13 stations in Parnu Bay and the Gulf of Riga and on the Parnu River by minimizing the discrepancies between the sea brightness coefficient computed from the model and the actual measured value. The ratios of the integral brightnesses of the ascending radiation in channels 1 and 2 of the MSU-M and MSU-SK satellite scanners differ by a factor of 1.3-1.4 for the eutrophic waters in these water bodies. Figures 3; references 16: 12 Russian, 4 Western.

UDC 551.463.288

### **Spatially Coherent Mesostructures in Oceanic Acoustic Noise Field**

18650148 Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 305 No 2, Mar 89 (manuscript received 4 Feb 88) pp 449-452

[Article by L. M. Mitnik, V. P. Dzyuba and V. I. Ilichev, academician, Pacific Ocean Oceanological Institute, Far Eastern Department, USSR Academy of Sciences, Vladivostok]

[Abstract] The atmosphere plays the key role in generation of acoustic dynamic noise in the ocean. The main natural sources causing variations in the intensity of oceanic noise  $I(f)$  at frequencies  $f$  equal to or greater than 0.5-1 KHz are the near-water wind and precipitation. With a speed of the main flow over the ocean 10 m/s appreciable  $I(f)$  changes occur in about 5 minutes. Ordered mesoscale structures with characteristic dimensions of several tens of kilometers have been discovered in the field of the near-water wind. The existence of these ordered mesoscale structures, detected from contact and remote measurements, means that a spatial coherence must be present in the fields of other physical parameters functionally related to the wind. Accordingly, a study was made of manifestation of mesoscale coherence in the field of acoustic noise in the ocean. The noise intensity is related to wind speed by a definite power-law dependence in which the exponent is dependent on frequency and atmospheric stratification. The ratio of the noise levels in regions with maximal and minimal  $I(f)$  values determines the amplitude of variations in mean noise intensity. The conditions under which spatially ordered structures observed in the field of the near-water wind will generate corresponding mesoscale structures in the field of dynamic noise in the ocean are defined. Figures 3; references 15: 7 Russian, 8 Western.

UDC 532.527

**Generation of Eddy Movements in Sea Water**

18650152 Dushanbe IZVESTIYA AKADEMII NAUK  
TADZHIKSKOY SSR: OTDELENIYE  
FIZIKO-MATEMATICHESKIKH, KHIMICHESKIKH  
I GEOLOGICHESKIKH NAUK in Russian  
No 2, Apr-Jun 89 (manuscript received  
1 Jul 87) pp 70-72

[Article by M. I. Kopp, S. S. Moiseyev, F. Kh. Khakimov and Sh. Shokirov, Space Research Institute, USSR Academy of Sciences; Tadzhik State University imeni V. I. Lenin]

[Abstract] The mechanism of generation of initial eddy disturbances in a stratified medium is investigated in the presence of density and salinity gradients with the values of these parameters changing smoothly along an arbitrarily selected direction. The point of departure is a system of hydrodynamic equations in the Boussinesq approximation. Salinity  $S = S_0 + S_1$  is represented in the form of the sum of its undisturbed part  $S_0(z)$  and fluctuating  $S_1(x, t)$  parts. The problem is examined in a coordinate system in which the OZ axis is directed vertically upward along the undisturbed density and salinity gradients, whereas the direction of the OX axis corresponds to the direction of the fluctuating flow. The conditions under which eddy disturbances are generated are defined in such a coordinate system. An expression is derived for the instability increment which shows that the viscosity and diffusion of sea water exert a stabilizing effect on the growth of initial disturbances. The conditions are defined under which the generation of eddy movements is possible in a poorly stratified (inhomogeneous) medium. References: 2 Russian.

UDC 551.466:532.59

**Approximation of Equatorially Trapped Waves in Numerical Models of Oceanic Dynamics**

18650154a Kiev MORSKOY GIDROFIZICHESKIY  
ZHURNAL in Russian No 2, Mar-Apr 89 (manuscript  
received 27 Nov 87, after revision 18 Jan 88) pp 14-21

[Article by S. G. Demyshev and Ye. V. Ostrovskiy, Marine Hydrophysics Institute, Ukrainian Academy of Sciences]

[Abstract] A study was made of the properties of solutions of linear shallow-water equations on an equatorial  $\beta$  plane. The properties of equatorially trapped waves were investigated as a function of three factors: type of grid (B or C), grid resolution  $p$  and wave resolution  $r$ . The cases  $p = 2$  and 4 corresponding to the minimal value of the equatorial radius of Rossby deformation 100 km and grid intervals 100 and 50 km were examined. The study was made using differential-difference schemes (differential in time). It was found that the spectrum for the B grid is symmetric relative to four-interval waves. This results in an incorrect sign on group

velocity in the range of wave lengths less than four grid intervals. An analytical solution was found for difference analogues of Kelvin and Yanai waves in the C grid. The advantages of the C grid are demonstrated. It is necessary to filter the high-frequency part of the spectrum for the B grid under the condition that the grid intervals are 100 km or less. Figures 5; references 10: 5 Russian, 5 Western.

UDC 551.466.31

**Modeling of Spectral Characteristics of Envelope of Wind Waves**

18650154b Kiev MORSKOY GIDROFIZICHESKIY  
ZHURNAL in Russian No 2, Mar-Apr 89 (manuscript  
received 24 Aug 87, after revision 16 Jun 88) pp 27-34

[Article by Yu. P. Solovyev, Marine Hydrophysics Institute, Ukrainian Academy of Sciences]

[Abstract] A method is proposed for determining the statistical characteristics of the envelope of wind waves. It is shown that for a normal random process the envelope of the correlation function determines the principal properties of the process envelope and can be expressed through the spectral width. No restrictions are imposed on the form or width of the spectrum. The model is effective for developing and steady waves when the attenuation of the time correlation function can be approximated by an exponential expression. Numerical computations and the experimental results are compared for typical wave conditions. The proposed envelope model is based on the linear properties of wind waves although the mechanism of formation of the wave spectrum may be essentially nonlinear. The main advantage of such an approach for describing the envelope is not only the simplicity of computations, but also the possibility of evaluating the parameters of groups of waves on the basis of wave formation conditions. For this it is adequate to find the dependence of the spectral width parameter on such parameters as wind speed and fetch. Figures 2; references 17: 11 Russian, 6 Western.

UDC 551.46.083:537.7

**Parametric Modeling of Spectra of Small-Scale Conductivity Fluctuations in Ocean**

18650154c Kiev MORSKOY GIDROFIZICHESKIY  
ZHURNAL in Russian No 2, Mar-Apr 89 (manuscript  
received 18 Jan 87, after revision 23 Jul 88) pp 34-39

[Article by V. I. Butyrev, I. I. Volkov and I. D. Lozovatskiy, Kuybyshev Polytechnic Institute; Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences]

[Abstract] The construction of models of the averaged statistical characteristics of processes is preferable to models of the processes themselves. Such statistical

characteristics include correlation and spectral functions. This makes possible a new approach to the parametrization of small-scale phenomena in the ocean. The limited number of parameters in such models can be used for determining statistical or functional relationships to the characteristics of large-scale hydrological structures. Parametric models of the statistical characteristics of small-scale hydrophysical processes can also be used effectively for establishing databases and data banks because using a small number of parameters it is possible to obtain any necessary number of estimates of spectral density in any frequency range (range of wave numbers). This article illustrates the applicability of these principles in constructing a parametric model of small-scale fluctuations of sea water conductivity. Experimental data were collected during the 13th cruise of the "Akademik Mstislav Keldysh" in the Western Atlantic in the Equatorial and Guiana test ranges using the "Baklan" towed probe with signal transmission to an on-board computer, in the first case at the horizon 87 m in a frontal zone on the northern periphery of the Lomonosov Countercurrent, and in the second case at the horizon 260 m in the neighborhood of a high-gradient interlayer several meters thick separating two layers homogeneous in temperature, salinity and density. The experimental findings are consistent with model computations. Figure 1; references 13: 10 Russian, 3 Western.

UDC 551.465.45

#### Hydrological Structure of Waters in Northwestern Tropical Atlantic

18650154d Kiev *MORSKOY GIDROFIZICHESKIY ZHURNAL* in Russian No 2, Mar-Apr 89 (manuscript received 29 May 87, after revision 6 Jul 87) pp 40-46

[Article by Yu. F. Bezrukov, Simferopol State University imeni M. V. Frunze]

[Abstract] Research carried out in the northwestern part of the Tropical Atlantic between 34 and 52° in September-October 1986 during the 34th cruise of the "Akademik Vernadskiy" has shed new light on the hydrological structure of waters in that area. The principal element of water circulation there was the Inter-Trade Countercurrent, a frontal zone between two water mass structures. In the salinity field, in addition to a meridional exchange of waters of subtropical and Antarctic origin, there was a significant zonal advection of waters

of low salinity. The collected data made it possible to discriminate the water masses, to determine their parameters and compute the corresponding water volumes. The thermohaline indices of the cores of the tropical and western equatorial water masses differed in their salinity. The final result of processing of the T,S curves is a three-dimensional statistical T,S diagram. The field of this T,S diagram is divided into classes in accordance with the adopted temperature and salinity intervals. Figures 5; references: 3 Russian.

UDC 532.591

#### Mathematical Simulation of Long-Wave Propagation Process

18650154e Kiev *MORSKOY GIDROFIZICHESKIY ZHURNAL* in Russian No 2, Mar-Apr 89 (manuscript received 22 Feb 88, after revision 16 Sep 88) pp 62-65

[Article by Yu. Z. Aleshkov and A. A. Bukatov, Leningrad Order of Lenin and Order of the Red Banner of Labor State University]

[Abstract] Since with approach to the shore wave height increases and the degree of nonlinearity need not be rigorously related to the degree of dispersion, the need has existed for a full model of the long-wave propagation process. Such a model was constructed by Yu. Z. Aleshkov in *IZV. AN SSSR: MZhG*, No 3, pp 173-176, 1985, a paper which also gave the results of research on the interaction between long waves and a vertical wall. Proceeding on the basis of this full model of the theory of long waves and applying the fundamental ideas of the ray method as employed by M. C. Shen (*SAIM REV.*, 17, No 1, pp 38-56, 1975), a study was made of the transformation of waves of great height in a basin of variable depth. The derivation of equations representing a full model of the process of propagation of long waves is given. These are then applied to the special case of a solitary wave with a given crest height; an equation is derived for determining the profile of such a wave. It is shown that the characteristics of a solitary wave are expressed through the height of its crest. With increasing distance from the crest, its height within the framework of a full model decreases more slowly than in a Korteweg-de Vries model. The greater the crest height, the greater is the difference in the distributions of its profile. Special expressions are then given for such phenomena in a basin of variable depth. References 10: 6 Russian, 4 Western.

**Declassification of Topographic Maps Compiled on Basis of Space Photos***18650191a Moscow PRAVDA in Russian  
12 May 89 p 8*

[Article by V. Yashchenko, head of the USSR Council of Ministers' Main Administration for Geodesy and Cartography; B. Byzov, head of the Military Topographic Administration of the General Staff]

[Excerpt] Necessary work for declassification of certain cartographic materials and space photographs is now in progress.

Taking into account present-day technical capabilities for compiling topographic maps with the aid of space photographs, topographic maps with scales of 1:200,000, 1:500,000 and 1:1,000,000 has thus been declassified. Work on compilation of maps for open sale has begun on the basis of maps which are on these scales.

Regarding duplication of work, it should be noted that more than 2,000 prospecting organizations of 32 ministries and agencies are conducting operations which are similar to those of divisions of the USSR Main Administration for Geodesy and Cartography which perform the bulk of the topographic and geodetic work in the USSR. Agencies of the USSR State Geodetic Inspection Service are supervising the work of these organizations.

FTD/SNAP

**Soviet Space Photographs Sold To U.S. Organizations***18650191b Moscow PRAVDA in Russian  
12 May 89 p 8*

[Article by V. Yashchenko, head of the USSR Main Administration for Geodesy and Cartography]

[Excerpt] A year ago, the Main Administration for Geodesy and Cartography sold the first multispectral positive film in natural and arbitrary color in the United States through "Soyuzkarta," an economic association which has been created for foreign trade.\* This film was shot over the state of Oregon, in the vicinity of the city of Astoria. These pictures, like many others, were obtained as a result of space photography with a KFA-1000 camera from a satellite of the "Kosmos" series. This camera has a focal distance of 1,000 millimeters. All phototechnical processing was done at the state center "Priroda."

A number of structures [in the Astoria area] were recorded with a precision of 30 centimeters.

An agreement for the sale of materials from remote probing of the earth from space was signed recently with Myron Lazerson, head of the American concern "Contrade Services Corporation." He and specialists of his

firm visited "Soyuzkarta" and the "Priroda" center in our country several times in order to work out this transaction.

Materials from Soviet space pictures have been purchased by about 200 foreign firms, including the U.S.' Institute of Aeronautics and Astronautics, "Space Commerce Corporation" and Association Press wire service.

"Soyuzkarta" and "Priroda" not only are exporting materials from space pictures but are performing a whole set of tasks connected with utilization of materials from remote probing of the earth for cartography aimed at the study of Earth natural resources. Proposals have now been made and work is in progress on carrying out such tasks in North Yemen, the United Arab Emirates, Peru, Costa Rica, and other countries.

FTD/SNAP

UDC 551.460:629.78

**Synoptic Waves in Tropical Atlantic Atmosphere and Their Relationship to Intertropical Convergence Zone Dynamics***18650088a Kiev MORSKOY GIDROFIZICHESKIY  
ZHURNAL in Russian No 1, Jan-Feb 89 (manuscript  
received 15 Jan 87, after revision 6 Oct 87) pp 3-11*

[Article by G. S. Dvoryaninov, V. M. Zhuravlev and A. V. Prusov, Marine Hydrophysics Institute, Ukrainian Academy of Sciences]

[Abstract] In an earlier article (MOR. GIDROFIZ. ZHUR., No 3, pp 3-17, 1987), the authors gave a validation of the maximal entropy method (MEM) for a multidimensional case and wrote an algorithm for evaluating spectral matrices on the basis of a correlation between this method and multivariate autoregression (AR) models. Proceeding on this basis, the MEM was used for investigating features of meteorological fields in the Tropical Atlantic. Emphasis is on study of mesoscale wave processes, their temporal evolution and restructuring as a function of meridional displacements of the intertropical convergence zone. Using the MEM, the intraannual variability of wave activity was studied in the eastern part of the Tropical Atlantic. The spectral composition of the wave field was investigated using pressure data for four meteorological stations on the west coast of Africa. It was found that in the studied region there are waves of a meridional direction whose dynamics is determined to a considerable degree by meridional displacements of the intertropical convergence zone in its annual cycle. Figures 5; references 14: 6 Russian, 8 Western.

UDC 551.465.7

**Temperature Profile and Heat Transfer in Free Turbulent Convection on Horizontal Surface**

18650093a Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 25 No 2, Feb 89 (manuscript received 8 Sep 87, after revision 9 Feb 88) pp 179-192

[Article by A. A. Grachev, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] Algebraic equations were derived describing the behavior of significant parameters for a current of stratified fluid near an aerodynamically smooth horizontal surface on the basis of closure of the turbulence equations. These equations under definite conditions are applicable for investigating the problem of free turbulent convection. For Prandtl numbers greater than 0.0166 the entire fluid layer is broken down into three regions: a sublayer of molecular thermal conductivity, a buffer zone and a region of well-developed turbulence. For each region the decisive parameter is represented in the form of a convergent power series, after whose integration the heat transfer law  $Nu = ARa^{1/3}$  is found and the dependence of the  $A$  coefficient on the Prandtl number is determined. The computation formulas are quite consistent with data from laboratory experiments. A full critical review of the pertinent literature is presented. Figures 3; references 44: 18 Russian, 26 Western.

UDC 528.8:519.21

**Fractal Dimensionality of IR Cloud Cover Images and Properties of Atmospheric Turbulence**

18650095a Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 89 (manuscript received 28 Jul 87) pp 17-26

[Article by Yu. S. Baryshnikova, G. M. Zaslavskiy, Ye. A. Lupyan, S. S. Moiseyev and Ye. A. Sharkov, Space Research Institute, USSR Academy of Sciences, Moscow]

[Abstract] Fractal dimensionality is a potentially effective tool for research on atmospheric turbulence, and the fractal dimensionality of cloud formation images has been computed in a number of American publications. This article gives an algorithm for computing fractal dimensionality from IR cloud cover images; the algorithm was used in processing satellite images of tropical cloud formations that preceded the birth of typhoons. It was discovered that in formations in which typhoons originate there is a greater number of zones with ordered movements than in formations in which typhoons do not originate. The proposed algorithm does not require great expenditures of computer time and makes possible a qualitative and, in some cases, a quantitative description of atmospheric turbulence. This suggests that the fractal

dimensionality approach may be useful in remote, on-line diagnosis of a number of atmospheric processes. Figures 5; 27 references: 18 Russian, 9 Western.

UDC 528.727

**Radiometric Correction of Aerospace Images**

18650095c Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 89 (manuscript received 4 Oct 86, after revision 23 Oct 87) pp 94-102

[Article by A. S. Barykin, AIUS-Agroresursy All-Union Scientific Research Center, Moscow]

[Abstract] The radiometric correction of terrain images that is examined in this article uses the approximation method and takes into account the specifics of the thematic problems to be solved; it calls for the use of a multiband scanning radiometer mounted on an aerospace platform as the survey system. In contrast to radiation correction methods that use the solution of boundary value problems for the atmospheric radiation transfer equation, the proposed method requires virtually no information on the physical parameters of the atmosphere and produces images with as much information yield as does the ratios method. This method can be used in increasing the accuracy of terrain element identification by comparing their reflectivity parameters against standard objects present on the same image. The mean statistical values of the atmospheric optical thickness are used in approximating the variations in illumination of the Earth's surface and atmospheric transparency. The errors in the approximation are evaluated. An example is given illustrating the effectiveness of the considered approach. Figures 5; references: 3 Russian, 2 Western.

UDC 528.72(202):551.51

**Methodology of the Automation of the Calibration and Processing Satellite HF Radiometer Data**

18650095d Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 89 (manuscript received 4 Nov 86) pp 103-114

[Article by A. B. Akvilonova, M. S. Krylova, B. G. Kutuza, B. Z. Petrenko, V. P. Sovorskiy and M. T. Smirnov, Radio Engineering and Electronics Institute, USSR Academy of Sciences, Moscow]

[Abstract] A method is proposed for automated processing of satellite multichannel HF radiometric data applicable to along-track measurements. Particular attention is devoted to the calibration of experimental data and the evaluation of the output parameters of HF radiometers. This method is a consolidation of experience in methodological research accumulated in the course of the processing and analysis of data collected by the "Cosmos" series of satellites (beginning with "Cosmos-243") and the "Intercosmos-20" and "Intercosmos-21" satellites. The entire processing cycle involves three

principal stages: rapid analysis, primary processing, and thematic (secondary) processing (each stage is discussed in detail). The data are normalized beforehand. The radiometers are calibrated against two standard sectors on the Earth's surface. A method for evaluating the effect of calibration errors on the accuracy in determining the brightness temperatures of the ocean-atmosphere system described. A method is given for automated choice of sectors from the file of experimental data corresponding to the control points on the Earth's surface, and procedures are proposed for evaluating the parameters of the directional pattern of the HF radiometer. Figures 3; references 22: 18 Russian, 4 Western.

UDC 528.7:528.8

### Computer-Aided Synthesis of Textures Simulating Earth's Surface

18650095e Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 89 (manuscript received 8 Jan 88) pp 115-121

[Article by G. A. Andreyev, A. A. Potapov, T. V. Galkina, A. I. Kolesnikov, T. I. Orlova and Ya. L. Khlyavich, Radio Engineering and Electronics Institute, USSR Academy of Sciences, Moscow; Voronezh State University]

[Abstract] Various methods have been proposed for the synthesis of surface textures, but all are encumbered by one deficiency or another. This article describes a linear autoregression synthesis model for this purpose and gives experimental data on determination of the statistical characteristics of optical and radio images. The computer-aided synthesis of a number of texture fields is effected. It is shown that correlation functions can serve as a basis for forming textures simulating natural textural images. In the synthesis of textures on the basis of correlation functions, use is made of discrete autoregression series predicting each image brightness element. An important stage in the synthesis of textures is a determination of the first- and second-order moments and construction of histograms of the distribution of brightnesses of real textures. Real textures are analyzed for this purpose. The initial textures used were aerial photographs and radio images of characteristic types of surfaces such as deciduous forests, corn fields, grassy areas, harvested fields, seas and sands. Experiments were carried out in autumn from a helicopter at heights of several tens of meters to several hundreds of meters. The processing procedures are described, followed by the essentials of the method for determining the parameters of the autoregression model and procedures for the computer synthesis of textures. Two methods were used in comparing the synthesized and real textures. This autoregression synthesis method involves use of a small number of parameters and small expenditures of computer time. Figures 4; references 11: 10 Russian, 1 Western.

UDC 551.521

### Absorption of Short-Wave Radiation by Tropospheric Aerosols. I. 'Clean' and Continental Air Masses

18650144a Tomsk OPTIKA ATMOSFERE in Russian Vol 2 No 3, Mar 89 (manuscript received 29 Nov 88) pp 227-233

[Article by O. B. Vasilyev, Leningrad State University]

[Abstract] Specialists in the Short-Wave Radiation Laboratory, Leningrad University, have accumulated adequate experimental data which make it possible to draw certain generalizations on the absorption of short-wave radiation by tropospheric aerosols. These materials do not make possible a complete classification of tropospheric aerosols with respect to their absorptivity, but serve as a foundation for such a classification. This first part of a two-part study gives the results obtained for relatively "clean" air masses and continental air masses of desert (sandy) and anthropogenic (smoke or dust) origin. In both cases there is a very strong integral absorption. The spectral variation of the influx of radiant energy of desert aerosol and some types of anthropogenic (smoke) aerosol has a maximum in the blue spectral region, duplicating the maximum in the spectral variation of the imaginary part of the refractive index of iron oxides (hematite, limonite, etc.). In some cases the anthropogenic (evidently, dust and some types of smoke) aerosol absorbs short-wave radiation nonselectively. Figures 4; references: 12 Russian.

UDC 551.521

### Absorption of Short-Wave Radiation by Tropospheric Aerosols. II. Aqueous Aerosol, Clouds and Multilayer Air Masses

18650144b Tomsk OPTIKA ATMOSFERE in Russian Vol 2 No 3, Mar 89 (manuscript received 29 Nov 88) pp 234-238

[Article by O. B. Vasilyev, Leningrad State University]

[Abstract] This is the second part of a two-part study (the first part is published in the same number of this journal, pp 227-233, giving experimental data on the spectral dependence of the true absorption of short-wave solar radiation in "clean" air masses and in air masses of continental origin). This second part examines the results of similar experiments in the case of presence of aqueous (or water-enveloped) aerosol in the atmosphere, in clouds and in multilayer air masses. It is shown that with respect to absorptivity the air masses observed in global and regional experiments can be divided into four major groups: a) nominally "clean" air masses (with no absorbing aerosol particles or virtually none); b) air masses containing "dry" continental aerosol; c) air masses containing "marine" (or aqueous) aerosol, formed either by water droplets or salt solutions)



or insoluble particles enveloped by condensed or sublimated water, possibly with insoluble particles on the surface of the water droplets; d) clouds. There are two types of "dry" aerosol: "desert" (sandy), in which the main absorbing component is evidently hematite, and anthropogenic, consisting of strongly and almost neutrally absorbing particles of soot and other substances associated with smoke, dust emanating from the soil, etc. Figures 3; references: 4 Russian.

UDC 551.593.13

### Scintillation Spectra Registered in Observations of Star Occultation Stars by Earth's Atmosphere

18650144c Tomsk OPTIKA ATMOSPHERY in Russian  
Vol 2 No 3, Mar 89 (manuscript received  
12 Dec 88) pp 239-245

[Article by A. S. Gurvich, Atmospheric Optics Institute, USSR Academy of Sciences, Moscow]

[Abstract] The spectrum of fluctuations of the light flux from a star observed through the atmosphere from aboard a spacecraft is computed with a stipulated spectrum of the refractive index, taking into account atmospheric refraction and sphericity. Specific examples are given of spectra of the refractive index which are used in determining the values of the parameters characterizing anisotropy for which the influence of atmospheric sphericity becomes important. In the case of anisotropic fluctuations of the refractive index in the atmosphere an analysis of the results of observation of extraterrestrial sources through the atmosphere from a spacecraft requires use of a model of fluctuations statistically locally uniform on a sphere. For this model general expressions are derived for computing the spectra of weak scintillations with stipulated spatial spectra of the inhomogeneities. In specific examples the computations are reduced to simple formulas making it possible to clarify the role of anisotropy. Examples of Gaussian and power-law spectra with arbitrary anisotropy coefficients are examined and it is shown that the criterion for the necessity to take atmospheric sphericity into account in an analysis of scintillation observation data is the parameter  $\eta^2 H_0 / a_c$ . Figure 1; references 13: 8 Russian, 5 Western.

UDC 510.551.42

### Coagulative Transformation of Optical-Microphysical Properties of Smoke Aerosols

18650144d Tomsk OPTIKA ATMOSPHERY in Russian  
Vol 2 No 3, Mar 89 (manuscript received  
29 Dec 88) pp 259-266

[Article by R. F. Rakhimov, Atmospheric Optics Institute, Siberian Department, USSR Academy of Sciences, Tomsk]

[Abstract] A method is proposed for numerical simulation of the process of coagulative transformation of the

optical-microphysical properties of aerosol. The fractional method for determining the particle-size distribution of atmospheric haze makes it possible to convert from traditional parameters to the integral criteria  $V_i$ ,  $S_i$ ,  $N_i$ —the total volumes, surfaces and numerical concentrations of individual fractions. This method, applicable for describing the structure of smoke, is attractive because the initial values of these parameters are more convenient for use in the parametrization of some sub-grid microprocesses (and the development of a reduced approach to the simulation of mesoscale processes). One such microprocess is the coagulation of aerosols constantly accompanying the evolution of a disperse system. A system of equations is derived which makes it possible to predict structural changes in the particle-size distribution as a result of the combined effect of the coagulation process, source and sink of particles. Three possible mechanisms of coagulative merging of aerosol particles are discussed, of which the third was selected as most probable. The approach was used in an analysis of the coagulative transformation of the optical-microphysical properties of smoke aerosols, relying heavily on nephelometric methods for registry of the angular functions of light scattering, which are highly sensitive to the slightest changes in the microstructure of the aerosol phase. The results of numerical simulation are given and compared with data from a laboratory experiment, the results confirming the soundness of the method. Figures 5; references 9: 8 Russian, 1 Western.

UDC 681.7.784

### Analysis of Stability of Algorithm for Retrieving Profile of Optical Components From Longitudinal Aberrations

18650144e Tomsk OPTIKA ATMOSPHERY in Russian  
Vol 2 No 3, Mar 89 (manuscript received  
14 Jul 88) pp 313-321

[Article by I. G. Polovtsev, Optika Special Design Bureau for Scientific Instrument Making, Siberian Department, USSR Academy of Sciences, Tomsk]

[Abstract] The longitudinal aberrations method is effective in checking optical components in major telescopes. The principles involved are reviewed. Although the method is well known, it has virtually not been applied in optical instrument making because of its low accuracy, due to the need for numerical integration (a difficulty which has been overcome since the introduction of computers) and because alternative methods were developed. The latter are complicated, of a low reliability and have proven deficient in a number of other ways. These considerations encouraged renewed research on the errors in the method for checking optical components when using the longitudinal aberrations method. Individual sections are devoted to the following aspects of the problem; error in measuring longitudinal aberration; error in marking of zones; error in measuring radius of curvature; error in measuring a priori parameters; error

associated with inhomogeneity of optical glass. Expressions are derived which make it possible to estimate the error in checking the profile of a component on the basis of longitudinal aberration in various schemes. Figures 4; references: 8 Russian.

UDC 551.508.769

### Research on Fluorescence Excitation Function of H<sub>2</sub>O Vapor

18650144f Tomsk *OPTIKA ATMOSFERY in Russian* Vol 2 No 3, Mar 89 (manuscript received 26 Dec 88) pp 322-323

[Article by V. M. Klimkin, S. F. Lukyanenko, I. N. Potapkin and V. N. Fedorishchev, Atmospheric Optics Institute, Siberian Department, USSR Academy of Sciences, Tomsk]

[Abstract] A series of lidar experiments with a KrF<sup>+</sup> laser revealed additional information on the fluorescence excitation function for H<sub>2</sub>O vapor (V. M. Klimkin, et al., *OPTIKA ATMOSFERY*, Vol 1, Nos 7, 8, 1988; Vol 2, No 1, 1989). It was discovered that there is a broad (280-400 nm) H<sub>2</sub>O fluorescence band excited in a single-photon absorption process which corresponds to a broad H<sub>2</sub> absorption band in the region less than 320 nm. That band together with the ozone absorption bands may play a definite role in protecting the Earth's surface against solar UV radiation. Using a narrow-band tunable laser [a diagram of the experimental apparatus accompanies the text], a detailed study was made of the long-wave wing of this water vapor UV absorption band. The form of the long-wave absorption band was registered with a resolution 0.03 nm, but some parts were registered with a resolution 0.003 nm. The band intensity is maximal at 270 nm and drops off smoothly in the direction of greater wavelengths. The limiting laser wavelength at which the fluorescence signal is discriminated from the noise caused by background fluorescence is 323 nm. This absorption band has a continuum nature; there is no evidence of a line structure. Figures 3; references 6: 3 Russian, 3 Western.

UDC 535.416.3

### Optimization of Positioning of Actuators in Plane Flexible Mirrors

18650144g Tomsk *OPTIKA ATMOSFERY in Russian* Vol 2 No 3, Mar 89 (manuscript received 3 Oct 88) pp 326-328

[Article by K. V. Shishakov and V. I. Shmalgauzen, Moscow State University imeni M. V. Lomonosov]

[Abstract] Wave front correctors with flexible mirrors in some cases make possible a considerable improvement in the quality of optical systems. The problem of constructing high-quality correctors with plane mirrors is inseparably related to the optimal positioning of actuators using the test of minimal rms error in the approximation of phase distortions. This article describes an approximate optimization of positioning of actuators in plane flexible mirrors

for the compensation of phase distortions of a light wave passing through a layer of the turbulent atmosphere. Computations were made for a correction system based on compensation of Zernike polynomials (it was demonstrated earlier (J. Wang, et al., *JOSA*, Vol 68, No 1, p 78, 1978) that such polynomials are convenient functions for describing the phase of a light wave passing through a turbulent atmospheric layer). The applicability of this optimization method is not restricted to plane mirrors; it can be used in the theoretical and experimental stages of planning of wave front correctors. Figure 1; references 3: 2 Russian, 1 Western.

UDC 537.86:535

### Electrical Model of Atmospheric Optical Transfer Function

18650144h Tomsk *OPTIKA ATMOSFERY in Russian* Vol 2 No 3, Mar 89 (manuscript received 14 Dec 88) pp 329-331

[Article by V. P. Budak and V. A. Selivanov, Moscow Institute of Communications]

[Abstract] In systems for remote sensing of the Earth attention must be given to the spatial-frequency distortions introduced in the formed image by the atmosphere (the atmosphere can reduce the spatial resolution of satellite TV images by half). The various approaches proposed for evaluating these distortions have serious deficiencies. However, taking into account the linear nature of these distortions and assuming that the aperture distortions introduced by the optical system and light signal sensor are also linear, it is possible to simulate the scattering properties of the atmosphere directly in the electrical channel of the TV system, making it possible to visualize them on a display. This involves use of a LF RC filter, having a virtually linear phase-frequency characteristic (PFC). For simulating the atmospheric PFC under changing atmospheric conditions the filter parameters must be varied, resulting in a change in the filter passband and a change in the optical transfer function. The number of computation parameters can be minimized. The block diagram of such an electrical model is illustrated and discussed. The practical applicability of such a model is illustrated using observations in the near-IR range. Figures 3; references 7: 5 Russian, 2 Western.

UDC 528.089.6(049.3)

### Problems in Metrological Support for Geodetic Instruments and Measurement Methods

18650153a Moscow *GEODEZIYA I KARTOGRAFIYA in Russian* No 11, Nov 88 pp 27-31

[Article by A. A. Genike and Ya. V. Naumov]

[Abstract] The system for metrological support of geodetic work in the USSR requires serious and immediate revamping. The proven methods which have been used for optical-mechanical theodolites, for example, are

inapplicable for many modern instruments. Considerable basic research is required. There are serious shortcomings in coordination of work between various geodetic agencies and the State Committee on Standards. There has been little attention to establishing precise calibration baselines, whereas intensive work of this nature has been proceeding in the United States, Canada, Australia and elsewhere. During recent years about 40% of the topographic pulsed-light range finders have not undergone periodic metrological tests either before or after the field season, suggesting that there is little hope of any possibility of increasing the quality of such measurements. Rather than achieving progress, there has been a continuing debate as to who should be responsible for metrological support. The State Committee for Standards has assumed such a role, but the sole result is a general confusion. The Main Administration of Geodesy and Cartography and other organizations have achieved individual successes, but many problems have remained unsolved. In some cases work is slowing down rather than accelerating. Certain agencies have declined to assist others and work in certain areas of the country has been neglected. One commission organized to solve baseline problems has never held a session. The specialists at universities and colleges seem to be contributing little to the solution of these problems. The costs of some work undertaken in this direction seem excessive relative to the results which have been realized. The immediate need for rectifying this situation is obvious. References 10; 4 Russian, 6 Western.

UDC 528.33(581)

#### **Plan for First-Order State Geodetic Network in Afghanistan**

18650153b Moscow GEODEZIYA I KARTOGRAFIYA  
in Russian No 11, Nov 88 pp 31-34

[Article by Bakhavol Darvesh (Afghanistan)]

[Abstract] At present only 15% of the territory of Afghanistan is supplied with geodetic points. Topographic maps at 1:50 000 and 1:100 000 compiled over 25 years ago with use of the radiogeodetic method do not meet modern accuracy requirements (at Kabul the horizontal error exceeds 200 m). This dictated the need for constructing a modern, highly precise geodetic network. Such a plan has been drawn up and provides for seven control points uniformly distributed over the area of the country [a map of the proposed first-order network accompanies the text]. Astronomical and gravimetric measurements have been made at the control points. The American Transit system was used in determining the coordinates of these control points; the coordinates of individual points were determined by the processing of satellite observations. Adjustment was by the least squares method and the final coordinates were computed. The accuracy in determining the position of the control points relative to the initial point is indicated in Table 1; the accuracy in computing distances is represented in Table 2. The accuracy in determining the

lengths between control points is 1:499 000- 1:1 751 000. The plan calls for another control point to be established, for one of the control points to be redetermined, and the entire network to be readjusted. The sequential steps in build-up of the first-order network are outlined, with a discussion of the accuracies expected. At Laplace points, for example, the rms errors must not exceed: astronomical latitude—0.2", longitude—0.02", azimuth—0.3". The Australian reference ellipsoid has been adopted for adjustment work. A series of instructions and regulations for implementation of this work has been published. Figure 1; references 4: 3 Russian, 1 Western.

UDC 528.063.1

#### **Computation of Convergence of Meridians and Scale of Gauss-Kruger Projection**

18650153c Moscow GEODEZIYA I KARTOGRAFIYA  
in Russian No 11, Nov 88 pp 34-36

[Article by V. N. Balandin]

[Abstract] Expressions are given for the convergence  $\gamma$  of meridians on a plane in a Gauss-Kruger projection and projection scale  $m$  as a function of geodetic coordinates  $B, l$  which ensure a quite high accuracy in determining  $\gamma$  and  $m$  when  $l$  is less than or equal to  $9^\circ$  (in actuality, less precise formulas are used in practical work). With an increase in longitude difference the highest accuracy in determining these parameters requires an increase in the number of expansion terms and therefore an increase in the volume of computations. With a longitude difference  $30^\circ$  or more the computations become extremely difficult. With a zone width  $30^\circ$  or more  $\gamma$  and  $m$  can be computed using recurrent formulas or a method in which a limited number of expansion terms is used. This article gives an algorithm making possible some reduction in the volume of computations for a broad zone using known expressions for plane rectangular coordinates  $x, y$  relative to the geodetic coordinates  $B, l$ . In this algorithm  $\gamma$  and  $m$  are computed using the fundamental formulas, but special formulas are applied for determining  $dx/dl, dy/dl$ . A simple and reliable formula is derived for the dependence between  $\gamma$  and  $m$ . Formulas are given for precise determination of unknown  $\gamma$  or  $m$  when only one of these parameters is known. A practical example of application of the algorithm is given. References: 5 Russian.

UDC 528.711.1(21)

#### **Joint Allowance for Collinearity and Coplanarity Conditions in Processing of Surface Photographs**

18650153e Moscow GEODEZIYA I KARTOGRAFIYA  
in Russian No 11, Nov 88 pp 44-47

[Article by R. N. Gelman]

[Abstract] Control geodetic directions are usually used in processing photographs of a ground stereophotogrammetric survey for determining the orientation elements.

Two or more such directions make it possible to determine the angular elements of outer orientation of the photograph and to ascertain focal length more precisely. However, a shortcoming of the control directions method is the need for selecting distinct terrain features in such a way that they are situated near opposite edges of a photograph, which is not always possible under real conditions. Therefore, for determining the orientation elements it is better to make additional use of the internal photogrammetric relationships of a stereopair of photographs. This makes it possible to increase the reliability of solution of the problem due to the incorporation of additional equations, a decrease in the necessary number of control directions to one per photograph and elimination of restrictions on choice of zones of control directions on a photograph. The joint use of control directions and internal photogrammetric relationships of a stereopair is based on allowance for collinearity and coplanarity conditions. The application of these principles is illustrated in computations of the relative accuracy in determining the elements of orientation of photographs for two variants of solution of the problem: using only control directions (collinearity condition) and with joint use of control directions and vertical parallaxes (collinearity and coplanarity conditions). In the study different numbers of control directions were used: two to five per photograph. It was found that in the second variant the accuracy in determining all orientation elements is improved. Figures 2.

UDC 528.711(203):625.7/8

### Modern Means for Aerial Engineering Survey for Construction of Transportation Facilities

18650153d Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 11, Nov 88 pp 41-44

[Article by V. P. Olokhtonov and A. P. Magich]

[Abstract] A new scientific and practical direction in the development and use of aerial methods is engineering field work based on use of data from remote sensing of the terrain in individual narrow zones of the visible spectrum of electromagnetic radiation. In this technology an important role is played by a multiband aerial photographic survey in areas where the construction of transportation facilities is planned. An An-30 aircraft and a Zeiss MSK-4 four-objective synchronously operating camera are used in such work. A multiband aerial survey can be made in four channels. It is now possible to combine the advantages of a survey using high-resolution black-and-white film and a color survey with enhanced interpretability of features not identifiable on monochromatic photographs. The desirability of using a multiband photosurvey in engineering work for highway construction is predetermined by a number of valuable properties. The interpretation of engineering conditions for route alinement from zonal photographs is more effective than when using ordinary aerial photographs. The metric and graphic qualities of MSK-4 photographs

are realized using a set of precise projection and photogrammetric processing instruments. This type of remote sensing is particularly important in evaluating the environmental impact which is associated with the construction of transportation lines and also in the planning and reconstruction of roads. References: 2 Russian.

UDC 528.232.2:681.3

### Microcomputer Solution of Linear Intersection on Surface of Terrestrial Ellipsoid

18650153h Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 11, Nov 88 p 57

[Article by K. A. Laping]

[Abstract] An algorithm is proposed for solving the linear intersection problem which is superior to that proposed by the author in GEODEZIYA I KARTOGRAFIYA, No 8, pp 36-37, 1985. This new algorithm makes it easy to compute the approximate geodetic coordinates of the point to be determined and the corresponding differential corrections for a more precise determination of the geodetic coordinates than possible when using traditional procedures. Two pairs of geodetic coordinates of the point to be determined are obtained at the same time. The program for solution of linear intersection in PASCAL is applied using an "Iskra-1030" microcomputer. This involves computation of the geodetic coordinates of the point to be determined and computation of the differential corrections  $V_1$  and  $V_2$  to the approximate geodetic coordinates of the point to be determined. The lengths of geodesics are easily computed using formulas cited in the literature. The geodetic coordinates of the point to be determined are computed by the approximations method. The process ends when the sum of the absolute values of the corrections  $V_1$  and  $V_2$  becomes less than 0.2". Two pairs of geodetic coordinates of a point are computed in 5 s. References: 3 Russian.

UDC 528.711.18

### Modified Method for Measuring Coordinates of Photograph Points

18650153f Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 11, Nov 88 pp 47-48]

[Article by O. V. Chernov]

[Abstract] Measurements from photographs using automatic stereocomparators are now made by two observers [the full procedure is concisely described]. The photograph coordinate points for both sets of observations are compared in a computer and nonmatching determinations (often 10% of all observations) are rejected. The analysis and processing of such observations increases computer time expenditures by 15%. The electronic recording devices used ("Onega" attachment to all types of stereocomparators, "SPA analytical stereoprojector—SM computer system") make it possible to process data stored on a magnetic carrier. An improved method for

making measurements on photographs by use of such outfits is proposed which to a great extent makes it possible to rectify shortcomings in the current procedures. The measurements in the first set are made in the usual way, with observational data registered on a magnetic disk. In the second set, after measuring the pertinent photograph parameters, these data are sent to the SM computer main memory. After the operator has observed a point the readings made in the instrument system are immediately scaled to the photograph system and compared with the coordinates of the same point obtained in the first set and stored on the magnetic disk. When there are coordinate discrepancies exceeding the tolerance an instruction calling for repetition of the observation is displayed. If the second observation is also beyond the tolerance, a display instruction is given for observation by a second observer. The final coordinates of the point represent the average obtained by different observers in the second set. The measurements are independent because the second observer does not know the results obtained by the first observer. The final coordinate file is superior to that possible with previous procedures.

UDC 528.735:528.711.1(202)

#### **Use of Results of Altimetric Measurements in Constructing Phototriangulation Networks From Space Images**

18650153g Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 11, Nov 88 pp 49-51

[Article by Ye. P. Aleksashin, T. I. Murunova, Yu. S. Timofeyev and A. M. Shirenin]

[Abstract] Altimetric measurements from the Apollo spacecraft were used in constructing lunar phototriangulation networks on the basis of a survey from the "Zond-8," but altimetric measurements can be made from any spacecraft, giving rise to difficulties in precise incorporation of the new measurements into the already constructed networks, which would necessitate constant corrections to the pertinent computer files. Procedures are proposed for facilitating such work and increasing the accuracy in network construction. A so-called "fictitious insertion of points" method is described which makes it possible to find the coordinates of points of altimetric measurements by solution of the inverse photogrammetric problem. Without including new points in the network, by photogrammetric measurements it is possible to transfer the elevations of the points of altimetric measurements to network points. This virtually excludes the errors associated with reorientation of the photographs in the instrument and errors in determining the elements of outer orientation. A block diagram clarifies the steps involved in incorporation of altimetric data in the adjustment of the photogrammetric network. The method was tested using "Zond"-Apollo data. The results of such an adjustment are given, showing that the transfer of altimetric measurements to network points is simpler than in the procedures previously used and is particularly effective in case when

vertical control is very thin, as would be the case for any planet or its satellites. Figures 2.

UDC 551.509.324.2:551.578.7

#### **Hail Prediction Methods**

18650165a Moscow METEOROLOGIYA I  
GIDROLOGIYA in Russian No 4, Apr 89 (manuscript  
received 19 Apr 88) pp 43-50

[Article by L. M. Fedchenko, doctor of geographical sciences, G. G. Goral, candidate of physical and mathematical sciences, and N. M. Malbakhova, High-Mountain Geophysical Institute]

[Abstract] A detailed method is proposed for hail prediction, with a description of the circulatory conditions and thermodynamic factors which must be taken into account in such predictions. The mesoregion of possible hailfalls is predicted using a group of conservative parameters characterizing atmospheric potential instability, determined by the vertical and horizontal distribution of pseudopotential temperature, and also with allowance for structure of the thermopressure fields of the upper and middle troposphere (this involves use of radiosonde data for determining potential instability parameters, a determination of "high hail-dangerous zones," as well as surface "potential instability lines"). Procedures for predictions of the intensity and type of hail process are also examined (an individual section is devoted to each aspect of the problem). The proposed procedures make it possible to predict the mesoregion of development, intensity and type of hail process 6-12 hours in advance. Predictions are prepared using radiosonde data for 0300, 0600 or 0900 hours, together with a prediction of maximal temperature for the current day. Factors of macro- and mesoscale circulation are determined from synoptic and pressure pattern charts. The developed procedures improve the reliability and information yield of hail predictions and favor formulation of a proper strategy for modifying hail-bearing clouds. Figures 3; references: 14 Russian.

UDC 551.577.2:504.3.054

#### **Correlation Between Distant Transport of Effluent From Major Industrial Regions and Large-Scale Redistribution of Precipitation**

18650165b Moscow METEOROLOGIYA I  
GIDROLOGIYA in Russian No 4, Apr 89 (manuscript  
received 18 Dec 87) pp 51-58

[Article by G. V. Dmitriyeva, candidate of geographical sciences (deceased), Applied Geophysics Institute]

[Abstract] The hypothesis of the possibility of redistribution of precipitation over extensive regions as a result of the distant transport of polluted air from large industrial regions is examined. The hypothesis is based on the observed correlation between the spatial-temporal distribution of monthly pollution anomalies, monthly precipitation totals, mean monthly circulation in the surface layer and the largest areal sources of pollution situated in Europe. The

study was based on surface pressure and precipitation data for January and July for the periods 1891-1940, 1891-1960 and 1891-1975. In regions of major pollution sources it is common to observe zones of relatively increased quantities of precipitation. In many cases zones of increased quantities of precipitation, beginning in the source regions, are drawn out along the direction of the transport trajectories as a continuous zone or are observed as spots situated at approximately equal distances from one another, sometimes hundreds or thousands of kilometers apart. An increased quantity of precipitation in the source region and along the path of transport of polluted air is observed most frequently under synoptic conditions favorable for precipitation, usually against the background of precipitation zones. There are cases when spots or bands of increased quantities of precipitation are accompanied by "conjugate" spots or parallel bands of reduced quantity of precipitation (a large-scale process of intensification of precipitation in one region is accompanied by a decrease in precipitation in an adjacent region). A relative increase in precipitation or a broadening of the precipitation zone may be associated with the group influence of different pollution sources. Figures 2; references 23: 16 Russian, 7 Western.

UDC 551.513.2:551.509.322

#### Method for Calculating Chart of Maximum Wind

18650165c Moscow *METEOROLOGIYA I GIDROLOGIYA* in Russian No 4, Apr 89 (manuscript received 30 Apr 88) pp 59-64

[Article by A. P. Ivanova, USSR Hydrometeorological Scientific Research Center]

[Abstract] A method was developed, based on wind data for different isobaric surfaces, for constructing a chart showing predicted values of the maximum wind. Such charts have isolines of the maximum wind plotted each 10 m/s, beginning with 30 m/s, and give the altitudes of the maximum wind on the jet stream axis. The individual steps in preparing such a chart are outlined. The method for computing the maximum wind was evaluated in three stages. The first involved a comparison of data on the maximum wind from radiosonde telegrams and maximum wind values computed using wind data for isobaric surfaces contained in these same telegrams. The second involved a comparison of data from an actual map of the maximum wind and values obtained by computations using objective analysis data. The third involved a comparison of actual data with the results of computations from predicted wind fields. The errors were analyzed in detail by a breakdown of the results by vertical and speed gradations. This analysis revealed that the proposed method for computing the speed and altitude of the maximum wind makes possible a successful determination of these characteristics, assuming a good quality of wind data at the isobaric surfaces. Figures 2; references 7; 5 Russian, 2 Western.

UDC 551.510.522:551.554(47+57)

#### Estimating Mesoroughness Using Rawin Data for Territory of USSR

18650165d Moscow *METEOROLOGIYA I GIDROLOGIYA* in Russian No 4, Apr 89 (manuscript received 11 Apr 88) pp 65-70

[Article by F. F. Bryukhan, candidate of physical and mathematical sciences, and L. V. Ponomarenko, Moscow State University]

[Abstract] Computations of the mesoroughness parameter, dynamic velocity and the coefficient  $\beta^{(k)}$  (which takes into account the deviation of the velocity profile from a logarithmic law) were made for 8 compass directions for 146 stations in the USSR for a 12 month period on the basis of climatic wind data at vane level and at heights 100 and 200 m. Maps of these parameters, averaged by directions for the four middle months of the seasons and mean annual conditions, were constructed. In the USSR three zones of the mesoroughness field can be defined: central, with increased mesoroughness, northern and southern with reduced mesoroughness. The mesoroughness in these zones is determined by the predominant type of vegetation (forest in the central zone, tundra in the north, steppe and wooded steppe in the south). Mesoroughness is characterized by a considerable variability in its annual variation and anisotropy relative to the oncoming air flow. An increase in mesoroughness from winter to summer is caused by disappearance of the snow cover and seasonal change in vegetation. The anisotropy of mesoroughness is associated with orography and the predominant directions of air movements. Near large cities the mesoroughness field is formed under the influence of the built-up city. Figures 2; references 12: 10 Russian, 2 Western.

UDC 551.465.62

#### Thermal Manifestations of Convection in Oceanic Near-Surface Layer

18650165e Moscow *METEOROLOGIYA I GIDROLOGIYA* in Russian No 4, Apr 89 (manuscript received 1 Mar 88) pp 71-77

[Article by A. I. Ginzburg, candidate of physical and mathematical sciences, and K. N. Fedorov, corresponding member, USSR Academy of Sciences (deceased), Oceanology Institute]

[Abstract] The "hierarchy" of horizontal scales of convection in the ocean, developing with heat transfer from the ocean to the atmosphere, and their possible manifestation in the temperature field of the oceanic near-surface layer, are discussed. Measurements were made in the Sargasso Sea in August 1978 from the "Akademik Kurchatov" research ship. Temperature was registered at 0.15 and 3 m, yielding data on the nature of thermal manifestations of convection in the nighttime hours. The article gives fragments of the temperature record near

the ocean surface registered while the ship was proceeding on course during the nighttime-early morning hours, as well as accompanying shipboard meteorological information. The possible causes of the registered temperature fluctuations at 100-m and 1-km scales are examined. The nature of these fluctuations and the relation of their amplitude to the computed values of the total heat flow from the ocean into the atmosphere strongly suggest that the observed fluctuations may be manifestations of convection. Figures 3; references 21; 16 Russian, 5 Western.

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**Response of Sea Ice Cover to Atmospheric Aerosol Pollution**

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GIDROLOGIYA* in Russian No 4, Apr 89 (manuscript  
received 18 Mar 88) pp 102-108

[Article by V. G. Savchenko, A. P. Nagurnyy and A. P. Makshtas, candidates of physical and mathematical sciences, Arctic and Antarctic Scientific Research Institute]

[Abstract] The possible consequences of an "aerosol winter" resulting from mass receipts of aerosol particles in the polar regions are assessed. This would result in conditions favorable for the almost complete disappearance of sea ice in the period immediately following such a catastrophe. Computations were made using a zero-dimensional thermodynamic model of the ice cover for the central part of the Arctic Basin. Changes in the characteristics of energy exchange between the atmosphere and the underlying surface in the high latitudes of the northern hemisphere induced by strong aerosol pollution in such a scenario are examined. A thermodynamic numerical model of evolution of the atmosphere-Arctic Ocean-sea ice system with few parameters is used in evaluating the role of sea ice in formation of zonal atmospheric circulation in the northern hemisphere. Calculations indicate that with passage of the years the area of sea ice would be restored slowly, but at least 20-40 years would be required for return to an equilibrium ice thickness. Figures 2; references 15: 9 Russian, 6 Western.

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**Experimental Research on Process of Hydrogen Sulfide Oxidation in Black Sea**

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Russian No 2, Feb 89 (manuscript received  
15 Sep 88) pp 3-6

[Article by A. A. Bezborodov, V. N. Yeremeyev and A. S. Romanov, Marine Hydrophysics Institute, Ukrainian Academy of Sciences, Sevastopol]

[Abstract] Experiments with the oxidation of hydrogen sulfide in samples of Black Sea water from the c-layer (layer of coexistence of oxygen and hydrogen sulfide) were carried out on the 18th cruise of the "Professor Kolesnikov" in May 1988 at two stations in the abyssal part of the sea. For the first time the experiments were made with natural concentrations of interacting components, without the addition of reagents. All operations were performed in an argon atmosphere. Water was sampled from different horizons within the c-layer, poured into argon-filled vessels and incubated for 20 days at 6-7°C. The incubated samples were periodically analyzed for oxygen and hydrogen sulfide content by photocolometric and titration methods. The results of the experiments were completely unexpected; in 3 of 4 samples there was no loss of hydrogen sulfide with time, even after 20 days. Accordingly, there was no H<sub>2</sub>S oxidation in water samples from the c-layer. It is postulated that the oxidation of H<sub>2</sub>S by oxygen in the c-layer of the Black Sea either does not occur at all or does not occur at all seasons and not at all horizons (the research was carried out in spring and only at three horizons). The absence of a H<sub>2</sub>S oxidation process in the c-layer is also confirmed by data on its microstructure. Oxygen profiles also indicate that such oxidation occurs for the most part not within the c-layer, but only at its upper boundary (in a layer no greater than 4 m thick) where the maximal oxygen consumption is observed. A kinetic oxidation curve is constructed. Figures 2; references 8: 7 Russian, 1 Western.

**Conversion of War Materiel for Use in Environmental Studies Urged**

18650180b Moscow PRAVDA in Russian 29 Apr 89 p 4

[Article by B. Surikov, retired general-major of aviation, candidate of technical sciences]

[Abstract] The article surveys possible directions for peaceful utilization of military and aerospace technology, production capacities and manpower affected by arms reductions which are in progress or planned.

Pointing out that defense enterprises have always produced items for use in the civilian sector (passenger

airplanes, ships, radioelectronic and communications equipment, etc.), the author suggests that some of defense industry's scientific-technical potential which is undergoing conversion be used in systematic solution of ecological problems, and that possibilities for controlled use of powerful rockets, strategic bombers and nuclear-powered submarines in this connection be evaluated. For example, medium-range and shorter-range missiles affected by the 1987 treaty with the United States are said to possess capabilities which could be used to good advantage in environmental studies. Under the terms of this treaty, only 154 of the SS-18 heavy missiles in the USSR's arsenal will remain at the disposal of the armed forces. The engines of these missiles are capable of placing a payload of several tons into space, it is noted.

The author thinks that such technology could be combined with other available aerospace and land- and sea-based systems, for quick and effective detection of threats to the environment in particular regions. In particular, experience amassed in 20 years of operation of the space meteorological-satellite system "Meteor" could be utilized in development of an ecological monitoring system, and it might be possible to adapt SS-18 rockets for launching satellites of this system. Ecological maps of the country and individual regions could be compiled on the basis of information received from these satellites, and they could be used also for monitoring dynamics of cloud and snow cover; observing volcanic activity, forest fires, and thermal non-uniformities of land and ocean surfaces; and surveying in support of agriculture.

Pointing out that airplanes possess a number of advantages over helicopters for infrared scanning and other methods of monitoring pollution, the author suggests that possibilities for converting heavy bombers into ecological laboratory airplanes be examined carefully. Strategic bombers with a cargo capacity of many tons and a radius of action of several thousand kilometers could be salvaged and modernized for this purpose, in particular. The equipment of these laboratory airplanes could include high-performance optical-electronic apparatus of the type that modern military reconnaissance aircraft carry. This apparatus would be useful for periodic inspection of industrial and lumbering enterprises located in remote areas, according to the author. Prospects for converting missile-carrying submarines into expedition vessels for use in ecological studies and the economy also ought to be looked into, in his opinion.

The author suggests that a temporary research group be created to evaluate possible ways of creating a state environmental monitoring system employing parts of former strategic weapons, and that joint Soviet-U.S. supervision of weapons conversion be organized if this project is approved. The research group could be set up at the USSR Academy of Sciences' Institute of Chemical Physics, which employs specialists in many fields, or at another suitable academy institute. The group's members would include both civilian scientists and specialists



of the armed forces and defense industry. In addition to determining the monitoring system's feasibility in principle, the group would draft proposals for development and production of ecological laboratory equipment. The

overall cost of the project is estimated at 200,000-250,000 rubles.

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